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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/681,609	05/08/2001	Gregory T. Stauf	Atmi-497	8601

25559 7590 05/19/2003

ATMI, INC.
7 COMMERCE DRIVE
DANBURY, CT 06810

EXAMINER

LE, THAO X

ART UNIT	PAPER NUMBER
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2814

DATE MAILED: 05/19/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

09/681,609

STAUF ET AL.

Examiner

Art Unit

Thao X Le

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 May 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-39 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-26,28-39 is/are rejected.
- 7) ☒ Claim(s) 27 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- 1) ☐ Certified copies of the priority documents have been received.
 - 2) ☐ Certified copies of the priority documents have been received in Application No. _____.
 - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's request for reconsideration of the finality of the rejection of the last Office action in Paper No. 9 is persuasive and, therefore, the finality of that action is withdrawn.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-8, 11-12, 14, 16-17 are rejected under 35 U.S.C. 102(e) as being anticipated by US 6294420 to Tsu et al.

Regarding to claims 1-5, Tsu discloses a microelectronic structure in fig. 1 comprising: at least one layer of high dielectric constant material 16, column 3 line 58, at least one conductive barrier layer 22, column 4 line 15, in contact with the layer of high dielectric constant material 16, wherein such conductive barrier layers comprises at least one material selected from the group consisting of TiAlN, column 4 line 37, at least one metal layer 20 in contact with the conductive barrier layer 22, wherein the metal layer 20 comprises metal or metal alloy including a material selected from the group consisting of Al, column 4 line 27, wherein at least one conductive barrier layer 22 is between at least one layer of high dielectric constant material 16

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and at least one metal layer 20, wherein when material of at least one metal layer is Al, at least one material of conductive barrier layer is not Ir or IrO₂.

Regarding to claims 6-8, Tsu discloses the layer of high dielectric constant material comprises BST, column 3 line 53.

Regarding to claims 11-12, 14 Tsu discloses a microelectronic structure wherein the conductive barrier 22 comprises Pt, Ru or Ir, column 4 line 53-54.

Regarding to claims 16-17, Tsu discloses a microelectronic structure wherein the conductive barrier 22 comprises TiAlN or TaN, column 4 line 36-37.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

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3. Claims 1-10, 18 are rejected under 35 U.S.C. 103(e) as being unpatentable over US 6365517 to Lu et al in view of US 6462931 to Tang et al.

Regarding to claims 1-3, Lu discloses a microelectronic structure in fig. 1 comprising: at least one layer of high dielectric constant material 24, column 4 line 62, at least one conductive barrier layer 2/22, column 4 line 33 and 57 in contact with the layer of high dielectric constant material 24, wherein such conductive barrier layers comprises at least one material selected from the group consisting of TiN, at least one metal layer 3 in contact with the conductive barrier layer 2/22, wherein the metal layer 3 comprises metal or metal alloy including a material selected from the group consisting of Cu and Al, column 4 line 39, wherein at least one conductive barrier layer 2/22 is between at least one layer of high dielectric constant material 24 and at least one metal layer 3, wherein when material of at least one metal layer is Al, at least one material of conductive barrier layer is not Ir or IrO₂.

But, Lu does not expressly disclose the conductive barrier material layer comprises TaN, NbN, HfN, ZrN, WN, W₂N, TiAlN, TaSiN, and NbAlN.

However, Tang reference discloses the conductive barrier TiAlN can be used to replaced TiN, column 9 line 26-29. At the time of the invention was made; it would have been obvious to one of ordinary skill in the art to replace barrier layer 2/22 of Lu with Tang conductive barrier, because such material substitution would have been considered a mere substitution of art-recognized equivalent values.

Regarding to claims 4-5, Lu discloses a microelectronic structure wherein the metal layer 3 comprises Cu, Cu alloy, Al or Al alloy, column 4 line 38.

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Regarding to claims 6-10, Lu discloses a microelectronic structure wherein the layer of high dielectric constant material 24 comprises a complex metal oxide selected from the group consisting of BST, BT, and PZT, column 5 lines 1-3, wherein the conductive barrier has the thickness in a range from about 1 nm to about 100nm or 5 nm to about 20 nm, column 4 line 5.

Regarding to claim 18, Lu discloses a microelectronic structure in fig. 1 comprising a first conductive barrier layer 2, a second conductive barrier layer 22, wherein the first conductive barrier is in contact with the layer of high dielectric constant material 2, the second conductive barrier layer overlies first conductive barrier layer and is in contact with the metal layer 3.

4. Claims 13, 15, 18-26, 28-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 6294420 to Tsu et al in view of US 6462931 to Tang et al.

Regarding to claims 13, 15 Tsu does not expressly disclose the conductive barrier layer comprises IrO_2 or RuO_2 .

However, Tang reference discloses the conductive barrier layer 116 comprises IrO_2 or RuO_2 , column 2 line 32-33. At the time of the invention was made; it would have been obvious to one of ordinary skill in the art to use conductive barrier teaching of Tang with Tsu, because such conductive barrier material would have been considered prevented the oxygen diffusion to the BST high k dielectric material as taught by Tang, column 2 lines 20-25.

Regarding to claim 18, 20-25, Tsu does not expressly disclose a microelectronic structure in fig. 1 comprising a second conductive barrier layer overlies first conductive barrier layer and is in contact with the metal layer 20.

But, Tsu discloses wherein the first conductive barrier 22 comprises TiAlN is in contact with the layer of high dielectric constant material 16. In addition, Tsu disclose the conductive barrier layer 22 can comprise multiple layers comprises Ir or Pt, column 4 lines 56. At the time the invention was made; it would have been obvious to one of ordinary skill in the art to use the teaching of Tsu to create s structure as claim, because it would have provided diffusion barrier for the BST layer as taught by Tsu, column 2 line 55-60. Also, it would have been obvious to one of ordinary skill in art to use teaching of Tsu as claimed, because it has been held that where the general conditions of the claims are discloses in the prior art, it is not inventive to discover the optimum or workable range by routine experimentation. See *In re Aller*, 220 F.2d 454, 105 USPQ 233, 235 (CCPA 1955). Furthermore, Tang reference discloses the conductive barrier layer 116 comprises IrO₂ or RuO₂, column 2 line 32-33. At the time of the invention was made; it would have been obvious to one of ordinary skill in the art to use conductive barrier teaching of Tang with Tsu, because such conductive barrier material would have been considered prevented the oxygen diffusion to the BST high k dielectric material as taught by Tang, column 2 lines 20-25.

Regarding to claims 19, Tsu disclose the first conductive barrier layer comprises Pt, column 4 line 53.

But, Tsu does not expressly disclose the second conductive barrier layer comprises IrO₂.

However, Tang reference discloses the conductive barrier layer 116 comprises IrO₂, column 2 line 32-33. At the time of the invention was made; it would have been

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obvious to one of ordinary skill in the art to use conductive barrier teaching of Tang with Tsu, because such conductive barrier material would have been considered prevented the oxygen diffusion to the BST high k dielectric material as taught by Tang, column 2 lines 20-25.

Regarding to claim 26, Lu discloses microelectronic structure comprises a conductive barrier layer 22 can comprise multiple layers, column 4 line 56, that is in contact with high dielectric layer 16

But Lu does not disclose the microelectronic structure comprises a first conductive barrier in contact the high dielectric layer, a second conductive barrier overlies the first conductive barrier, and a third conductive barrier overlies second conductive barrier layer and in contact with the metal layer.

However, Tang reference discloses in fig. 9a the microelectronic structure comprises a first conductive barrier Ir in contact the high dielectric layer BST, a second conductive barrier IrO_2 overlies the first conductive barrier Ir, and a third conductive barrier Ir overlies second conductive barrier layer IrO_2 and in contact with the metal layer Al. At the time the invention was made; it would have been obvious to one of ordinary skill in the art to combine the diffusion barrier teaching of Tang with Lu, because it would have provided a low leakage currents and limited dielectric degradation as taught by Tang, column 1 line 57-58.

Regarding to claims 28-31 as discussed above claims Tsu, and Tang disclose all the limitations of claims 28-31.

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Regarding to claims 32-39, Tsu and Tang discloses a microelectronic structure comprises different device such as memory cell capacitor, see background of the invention and summary of the invention. Therefore, it would have been obvious to one of ordinary skill in the art to apply the microelectronic structure teaching of Tsu and Tang for intended use.

Allowable Subject Matter

5. Claim 27 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The prior art of record does not disclose all the limitations of the claim 27 including a first conductive barrier comprises IrO_2 , a second conductive layer comprises Ir_2O_3 , and a third conductive barrier layer comprises Ir.

Response to Arguments

6. Applicant's arguments with respect to claims 1-39 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO**

MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thao X Le whose telephone number is 703-306-0208. The examiner can normally be reached on M-F from 8:00 AM - 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael M Fahmy can be reached on 703-308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Thao X. Le
May 13, 2003



PHAT X. CAO
PRIMARY EXAMINER